

**INTI INTERNATIONAL UNIVERSITY**

**Faculty of Engineering and Quantity Surveying**

**COMPARATIVE STUDY ON THE DESIGN OF PAD FOUNDATION  
BASED ON BS 8110, EN 1992 AND ACI 318**

**Victor Kumala Putra  
B.Eng (Hons) in Civil Engineering**

**Project Supervisor  
Assoc. Prof. Dr. Panjehpour**

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## SUPERVISOR'S DECLARATION

This project report entitled "COMPARATIVE STUDY ON THE DESIGN OF PAD FOUNDATION BASED ON BS 8110, EN 1992 AND ACI 318" is prepared and submitted by VICTOR KUMALA PUTRA (I14007059) as partial fulfilment of the requirement for the Bachelor of Engineering (HONS) in Civil Engineering, INTI International University.

APPROVED BY:


*Dr. Panjeh Pour*  
.....

Date ..... 4/5/18 .....

Supervisor

## STUDENT'S DECLARATION

I hereby declare that the final year project is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at INTI INTERNATIONAL UNIVERSITY or other institutions.

Signature	:	 .....
Student Name	:	Victor Kumala Putra .....
Student ID	:	I114003059 .....
Date	:	4/5-2018 .....

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## ABSTRACT

This paper presents a comparative study of pad foundation design outcomes based on BS 8110, EN 1992 and ACI 318 by using design spreadsheets. This study compares the flexure, shear and punching shear performance, by considering axial load and biaxial moments. The study is focused on some critical input parameters: concrete cover, size of pad foundation and size of column based on a conventional building (residential and commercial). Pad foundation models have been developed by using Autodesk Robot Structural Analysis to verify the flexure and shear. The obtained results compared are leading to some conclusions. For bending performance, EC design requires less area of tensile reinforcement, followed by BS design and ACI design. For shear performance, ACI design results in the lowest shear stress, followed by EC design and BS design. For punching shear performance, EC design results in the lowest punching shear stress, followed by BS design and ACI design. For overall performance, EC design provides the most economical design, followed by BS design and ACI design.

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## LIST OF ABBREVIATIONS

BS 8110:

$\gamma_{mc}$	:	partial safety factor of material
$\gamma_c$	:	partial safety factor of concrete
$\gamma_s$	:	partial safety factor of steel
$f_{cu}$	:	characteristic compressive cube strength of concrete
$f_y$	:	characteristic tensile strength of reinforcement
$G_k$	:	characteristic dead load
$Q_k$	:	characteristic live load
$W$	:	design ultimate load
$M_u$	:	design ultimate moment of resistance
$M$	:	design ultimate moment
$M_{face}$	:	design ultimate moment at column face
$F_{cc}$	:	compression force in the concrete
$F_{st}$	:	tension force in the reinforcement
$z$	:	lever arm
$x$	:	depth to neutral axis
$b$	:	width of section
$d$	:	effective depth to the tension reinforcement
$d'$	:	effective depth to the compression reinforcement
$c$	:	nominal cover to reinforcement
$h$	:	overall depth of section
$K$	:	coefficient given by $M/f_{cu}bd^2$
$K'$	:	coefficient given by $M/f_{cu}bd^2 = 0.156$
$A_s$	:	area of tension reinforcement
$A'_s$	:	area of compression reinforcement
$p_s$	:	earth pressure
$v_c$	:	design concrete shear stress

$v_{max}$	:	maximum shear stress at column face
$V_{transverse}$	:	design ultimate transverse shear force
$v_{transverse}$	:	design ultimate transverse shear stress
$p_{crit}$	:	critical perimeter
$V_{punching}$	:	design ultimate punching shear force
$v_{punching}$	:	design ultimate punching shear stress

EN 1992:

$\gamma_{mc}$	:	partial safety factor of material
$\gamma_c$	:	partial safety factor of concrete
$\gamma_s$	:	partial safety factor of steel
$f_{cu}$	:	characteristic compressive cube strength of concrete
$f_{ck}$	:	characteristic compressive cylinder strength of concrete
$f_{cd}$	:	design compressive strength of concrete
$f_{yk}$	:	characteristic yield strength of reinforcement
$f_{yd}$	:	design yield strength of reinforcement
$G_k$	:	characteristic permanent action
$Q_k$	:	characteristic variable action
$W$	:	design ultimate load
$V_{Ed}$	:	design ultimate shear force
$M_{Rd}$	:	design ultimate moment of resistance
$M_{Ed}$	:	design ultimate moment
$M_{face}$	:	design ultimate moment at column face
$F_{cc}$	:	compression force in the concrete
$F_{st}$	:	tension force in the reinforcement
$z$	:	lever arm
$x$	:	depth to neutral axis
$b$	:	width of section
$d$	:	effective depth to the tension reinforcement
$d_2$	:	effective depth to the compression reinforcement
$c$	:	nominal cover to reinforcement

$h$	:	overall depth of section
$a$	:	distance from the periphery of the column to the control perimeter considered
$K_0$	:	coefficient given by $M_{Ed}/f_{cu}bd^2$
$K_0'$	:	coefficient given by $M_{Ed}/f_{cu}bd^2 = 0.167$
$A_{s1}$	:	area of tension reinforcement
$A_{s2}$	:	area of compression reinforcement
$\rho_1$	:	reinforcement ratio corresponding to $A_{s1}$
$p_E$	:	earth pressure
$k$	:	a coefficient relating to section depth
$v_{min}$	:	minimum shear stress
$\sigma_{cp}$	:	average compressive stress in concrete due to axial force
$N_{Ed}$	:	axial force in the cross-section
$A_c$	:	cross-sectional area of concrete
$v_{Ed} (face)$	:	design shear stress at column face
$v_{Rd,max}$	:	maximum shear stress, limited by crushing resistance of compression strut
$v$	:	strength reduction factor for concrete cracked in shear
$\alpha_{cc}$	:	a coefficient taking account of sustained compression
$V_{Ed,red} (transverse)$	:	design ultimate transverse shear force
$v_{Ed} (transverse)$	:	design ultimate transverse shear stress
$u_0$	:	length of column periphery
$u_1$	:	critical perimeter
$\Delta V_{Ed}$	:	net upward force within the control perimeter
$V_{Ed,red} (punching)$	:	design ultimate punching shear force
$v_{Ed} (punching)$	:	design ultimate punching shear stress

#### ACI 318:

$f_{cu}$	:	characteristic compressive cube strength of concrete
$f'_c$	:	characteristic compressive strength of concrete
$f_y$	:	characteristic yield strength of reinforcement